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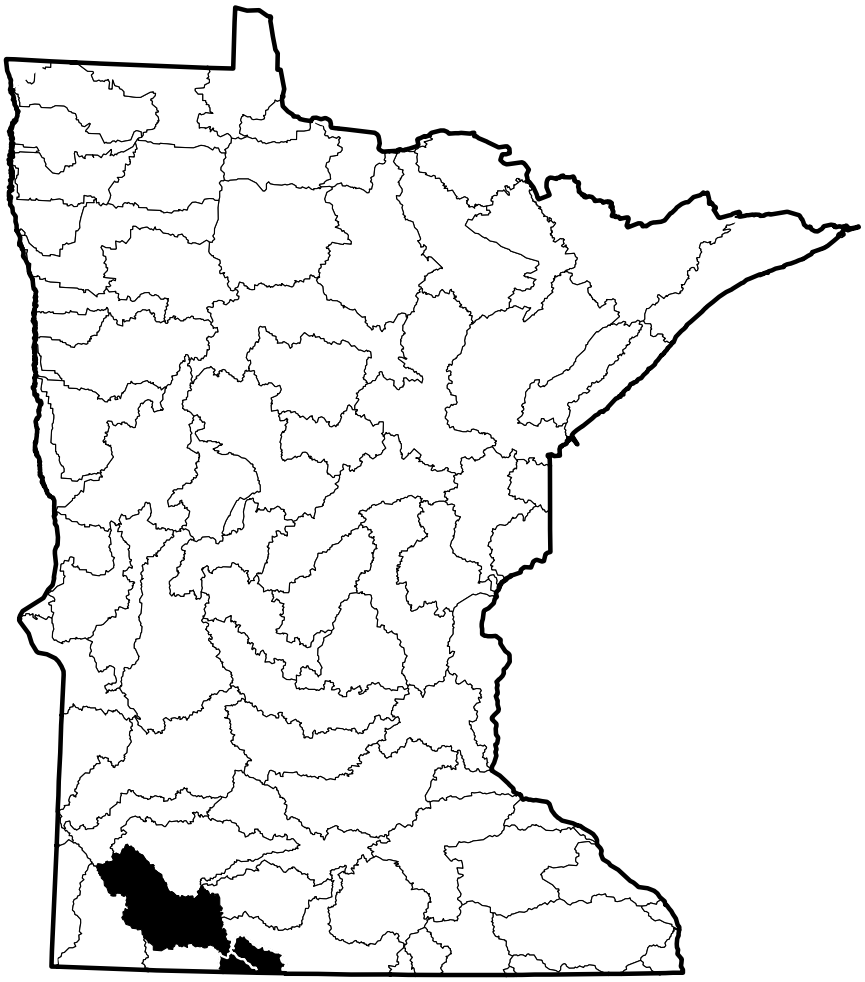
PHYSICAL CHARACTERISTICS OF STREAM SUBBASINS IN THE DES MOINES RIVER, UPPER DES MOINES RIVER, AND EAST FORK DES MOINES RIVER BASINS, SOUTHWESTERN MINNESOTA AND NORTHWESTERN IOWA

By Christopher A. Sanocki

Open-File Report 99–474



Prepared in cooperation with the

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Physical Characteristics of Stream Subbasins in the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins, Southwestern Minnesota and Northwestern Iowa

By Christopher A. Sanocki

Abstract

Data that describe the physical characteristics of stream subbasins upstream from selected sites on streams in the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins, located in southwestern Minnesota, and northwestern Iowa, are presented in this report. The physical characteristics are the drainage area of the subbasin, the percentage area of the subbasin covered only by lakes, the percentage area of the subbasin covered by both lakes and wetlands, the main-channel length, and the main-channel slope. Stream sites include outlets of subbasins of at least 5 square miles, and locations of U.S. Geological Survey high-flow, and continuous-record gaging stations.

Introduction

This is the 17th report in a series detailing subbasin characteristics of streams in Minnesota and adjacent states. The three hydrologic units presented in this report cover only the area of the basins that have some upstream drainage area within Minnesota. The upstream drainage area for each watercourse was determined at the Minnesota State line. In some instances the drainage area included flow from across state lines see plate 1.

The Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins drain an area of 1,557.9 square miles and is represented by hydrologic accounting unit 07100001, 07100002, and 07100003 (U.S. Geological Survey, 1974). The Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins include parts of Cottonwood, Jackson, Lyon, Martin, Murray, Nobles, and Pipestone Counties in southwestern Minnesota and Dickinson and Emmet Counties in northwestern Iowa.

Selected data for sites on streams at outlets of subbasins larger than about 5 square miles; at locations of U.S. Geological Survey (USGS) high-flow, and continuous-record gaging stations located in the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins are presented in this report. This report was prepared in cooperation with the Minnesota Department of Transportation.

Acknowledgments

Banette Kritzky, a graduate student at St. Cloud State University, and Brian Fischer a graduate student at University of Minnesota, did much of the digitizing and assisted in the preparation of this report. These contributions were essential for the completion of this report.

Methods

USGS 7-1/2 minute series topographic maps were used as source maps to obtain the areas for the subbasin boundaries, the main-channel length, and the contour elevation points used in this report. Paper copies of the maps were used. Lake and marsh data were obtained from U.S. Fish and Wildlife Service National Wetlands Inventory Data (U.S. Fish & Wildlife Service, 1981-present). A geographic information system (GIS) was used to define the geographic location and extent of the subbasins, lakes, marshes, main-channels, and elevation points. Data digitized from paper copies were in error by no more than twice the horizontal accuracy of National Mapping Standards of 40 feet (Thompson, 1987, p. 104). All thematic (digitized) data were projected into an Albers Equal-Area projection for storage and analysis.

Subbasin boundaries were delineated on the basis of anthropogenic activities and topographic contours. Anthropogenic activities, such as the installation of storm sewers, the drainage of wetlands, and the diversion of streams, may alter the drainage area of a stream. Data from field inspections and recent drainage-ditch maps, therefore, were transferred to the topographic maps. The subbasin boundaries were digitized by the Minnesota Department of Natural Resources (DNR), and the USGS Minnesota using a GIS.

Lake and marsh boundaries were overlaid on the subbasin boundaries to associate each lake and marsh with a subbasin. The total area of lakes and marshes within each subbasin was calculated by the GIS. Total marsh area plus total lake area is defined as storage area.

Main channels were delineated for each subbasin on the 7-1/2 minute topographic maps starting at the outflow of the subbasin and continuing upstream. Whenever the main channel joined with another stream, the stream upstream of the junction that drained the largest area was selected as the main channel. The main channel, which represents the watercourse that drains the greatest area, is continuous and is defined as a single trace that passes through marshes, lakes, and midline of rivers and braided streams from the basin outlet to an endpoint in the basin, generally at the basin divide. The main channels were digitized by the Minnesota Department of Transportation, using a computer aided drafting system and transferred to the GIS. Stream extensions that represent a portion of the main channel from the end of the mapped stream (blue line on 7-1/2 minute topographic maps) to an endpoint within the basin, generally at the basin divide, were digitized by USGS Minnesota using a GIS. The main-channel data were overlaid onto the subbasin data to associate each main channel with its subbasin.

Elevation points were digitized at the intersection of topographic contour lines and main channels. The elevation data were digitized using a GIS. The elevation data was overlaid onto the main channel data to associate each elevation data point with a main channel. Two points on the main-channel, at 10 percent and at 85 percent of the main channel length from the basin outlet to the drainage divide, were located by the GIS. The elevations of these two points were interpolated from the digitized elevation data. Main-channel slope was calculated by dividing the difference in elevation between these points by the distance along the stream channel between these points.

Physical Characteristics of Des Moines River, Upper Des Moines River, and East Fork Des Moines River Subbasins

Physical characteristics determined for each of the subbasins shown on plate 1 are presented in table 1. Subbasins are presented in order from headwaters to mouth. The rank of the subbasin stream is shown by indentation; whenever two subbasin streams joined, the stream draining the least cumulative area was assigned a lower rank and indented in the table.

The data for drainage area, and main-channel length are reported using three significant figures or rounded to the nearest one-hundredth of a unit. The data for lake area and storage area are reported using two significant figures or rounded to the nearest one-tenth of a percent. The data for main-channel slope is reported to the nearest one-tenth of a foot per mile.

The following is an explanation of the terms used in table 1:

Subbasin number. A seven digit number based on the Minnesota Common Stream and Watershed Numbering System (Minnesota Department of Natural Resources, 1981). The first two digits are 51, 52, and 53 and identify the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins. The following three digits are arbitrary and were assigned by the DNR. The last two digits were added by the USGS Minnesota, to identify additional subdivisions to the DNR's watersheds at locations of USGS gaging stations and to identify noncontributing areas.

Stream name. The name of the stream or ditch shown on 7-1/2 minute topographic maps. The relative position of the subbasin above other subbasins, streams, and gaging stations.

Outlet location. The U.S. Public Lands Survey System is used to describe the location where the stream exits the subbasin, down to quarter-quarter section. The description includes quarter-quarter section, section, township, and range.

Drainage area. That area, measured on a horizontal plane, enclosed by a topographic divide, within which direct surface runoff from precipitation normally flows by gravity into a watercourse above a specific point. This may include closed basins and other areas that do not contribute directly to surface runoff.

Lake area. The percentage of the drainage area labeled lacustrine (lakes) on U.S. Fish and Wildlife Service National Wetlands Inventory Data.

Storage area. The percentage of a drainage area labeled lacustrine (lakes) and palustrine (wetlands) on U.S. Fish and Wildlife Service National Wetlands Inventory Data. Marsh areas shown on plate 1 are from USGS 1:100,000 digital line graph data, 1993.

Main-channel length. The total length of the main channel from the basin outlet to a point within the basin (generally at the basin divide) representing the watercourse that drains the greatest area.

Main-channel slope. The average slope of the watercourse between the points at 10 and at 85 percent of the distance along the main channel from the basin outlet to the drainage divide.

Stream extension. A representation of the main channel from the end of the mapped stream line (blue line on 7-1/2 minute topographic maps) to an endpoint within the basin, generally at the basin divide. This is done by interpreting topographic relief so that the extension of the main channel represents the watercourse draining the greatest area.

References Cited

Minnesota Department of Natural Resources, 1981, The common stream and watershed numbering system: Minnesota Department of Natural Resources Stream Inventory and Data Retrieval Systems Report 7002, unpaged.

Thompson, M.M., 1987, Maps for America, 3d edition: U.S. Geological Survey, 265 p.

U.S. Geological Survey, 1974, Hydrologic unit map--1974 State of Minnesota: 1 plate, scale 1:500,000.

U.S. Fish & Wildlife Service, National Wetlands Inventory Digital Data: Oct. 1981 to present

Table 1.—Physical characteristic data for the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
	First Rank / Second Rank / Third Rank / Fourth Rank / Fifth Rank												
5100500	Unnamed tributary to subbasin 5100600	SW NE	04	107N	43W	15.1	0.6	4.1	15.1	0.6	4.1	10.3	19.8
5100400	Unnamed tributary to subbasin 5100600	SW NE	04	107N	43W	5.27	0.0	12.3	5.27	0.0	12.3	7.21	4.9
5107100	Judicial Ditch No. 14	SW SE	08	106N	42W	28.6	0.0	2.2	28.6	0.0	2.2	15.6	14.4
5100600	Beaver Creek above County Ditch No. 20	NW NE	09	106N	42W	37.6	0.4	4.4	86.6	0.3	4.1	27.6	6.1
5108400	County Ditch No. 20 above Great Oasis Lakebed	NE SW	16	107N	42W	20.1	0.0	2.5	20.1	0.0	2.5	7.36	4.0
5107500	Great Oasis Lakebed	NW SE	16	107N	42W	7.78	0.0	4.0	7.78	0.0	4.0	4.67	5.0
5107200	Unnamed tributary to County Ditch No. 20	SE NE	05	106N	42W	5.48	0.0	0.5	5.48	0.0	0.5	5.80	11.9
5107300	County Ditch No. 20	SE SW	04	106N	42W	6.69	0.0	0.9	40.0	0.0	2.3	12.4	2.6
5107400	Beaver Creek above County Ditch No. 18	SE NE	32	107N	41W	13.0	0.0	1.5	140.	0.2	3.4	38.5	3.9
5107600	County Ditch No. 18	SE NE	32	107N	41W	8.24	0.0	2.2	8.24	0.0	2.2	6.49	14.2
5107002	Unnamed tributary above gaging station near Slayton: station number is 05474750	NW NW	17	106N	41W	5.01	2.3	3.6	5.01	2.3	3.6	4.80	25.7
5107001	Unnamed tributary above gaging station near Slayton: station number is 05474760	NE NE	17	106N	41W	2.22	0.0	0.4	2.22	0.0	0.4	5.15	35.4
5107000	Unnamed tributary to Beaver Creek	NW NW	10	106N	41W	3.77	0.0	0.5	11.0	1.1	1.9	8.10	19.1
5106900	Beaver Creek	NW NW	17	107N	40W	18.9	0.1	1.8	178.	0.2	3.0	57.9	3.6
5108500	County Ditch No. 26	NW NW	09	108N	42W	16.8	0.2	4.1	16.8	0.2	4.1	11.6	9.3
5108600	UnnamedTributary to County Ditch No. 48	NW NW	09	108N	42W	9.29	10.6	16.5	9.29	10.6	16.5	5.85	18.8
5108700	County Ditch No. 48	SE SE	25	109N	42W	9.39	0.0	3.0	35.5	2.9	7.1	19.1	10.7
5108800	Unnamed tributary to subbasin 5108900	SE SE	25	109N	42W	6.97	0.0	10.2	6.97	0.0	10.2	7.72	21.2
5110900	Unnamed tributary to subbasin 5108900	SE SE	24	109N	42W	5.93	12.9	19.1	5.93	12.9	19.1	3.48	1.4

Table 1.—Physical characteristic data for the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins—Continued.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
	First Rank / Second Rank / Third Rank / Fourth Rank / Fifth Rank												
5108900	Unnamed tributary to Lake Shetek	NE SW	11	108N	41W	13.6	2.2	7.4	62.0	3.4	8.6	29.3	7.3
5108300	Unnamed tributary to Lake Maria	NE NW	17	108N	41W	8.56	0.0	1.6	8.56	0.0	1.6	6.32	20.7
5108200	Lake Sarah	NE SE	21	108N	41W	10.9	21.0	26.0	19.5	11.8	15.3	8.67	15.6
5108100	Unnamed tributary to Lake Shetek	SE SE	35	108N	41W	7.90	0.3	5.3	27.3	8.5	12.4	13.7	10.4
5107700	Unnamed tributary to Lake Shetek	NW SW	12	107N	41W	5.65	0.3	3.1	5.65	0.3	3.1	4.36	26.1
5107800	Lake Shetek	NW NW	17	107N	40W	33.2	20.2	24.8	128.	8.7	13.4	38.3	5.6
5107900	Des Moines River above subbasin 5106800	NW SW	22	107N	40W	5.89	0.0	5.6	312.	3.7	7.3	62.5	3.8
5106800	Unnamed tributary to Des Moines River	NW SW	22	107N	40W	4.11	0.0	0.5	4.11	0.0	0.5	4.44	26.3
5106700	Unnamed tributary to Des Moines River	NW SW	26	107N	40W	8.58	0.0	2.0	8.58	0.0	2.0	9.51	12.4
5108000	Devils Run	NE SE	07	106N	39W	16.0	1.5	11.9	16.0	1.5	11.9	12.4	6.5
5106500	Des Moines River above subbasin 5106600	NE SW	20	106N	39W	15.0	0.0	4.9	355.	3.3	7.2	78.0	3.6
5106600	Unnamed tributary to Des Moines River	NE SW	20	106N	39W	7.91	0.0	6.8	7.91	0.0	6.8	8.91	13.9
5106300	Unnamed tributary to Des Moines River	NE SE	20	106N	39W	3.87	0.0	1.6	3.87	0.0	1.6	6.21	19.5
5106400	Des Moines River above Lime Creek	SW NW	27	106N	39W	5.96	0.0	4.3	373.	3.1	7.1	83.0	3.5
5105800	Unnamed tributary to subbasin 5105700	SW NE	34	106N	41W	6.16	0.0	1.9	6.16	0.0	1.9	8.91	20.6
5105600	Unnamed tributary to subbasin 5105700	SW NW	35	106N	41W	10.1	5.6	11.2	10.1	5.6	11.2	8.06	13.2
5105700	Unnamed tributary to subbasin 5106100	NW NW	35	106N	41W	12.0	0.0	2.8	28.2	2.0	5.6	13.0	12.6
5106000	Unnamed tributary to subbasin 5106100	NW NW	35	106N	41W	9.51	0.0	1.1	9.51	0.0	1.1	9.57	22.0
5106200	Judicial Ditch No. 10	NE SE	30	106N	40W	12.4	0.0	0.7	12.4	0.0	0.7	7.90	6.3
5106100	Unnamed tributary to Lime Lake	SW SW	29	106N	40W	7.13	0.0	9.3	57.3	1.0	4.2	18.3	9.6
5105500	Lime Creek	SW NW	27	106N	39W	42.0	1.5	2.8	99.3	1.2	3.6	46.0	5.0

Table 1.—Physical characteristic data for the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins—Continued.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
	First Rank / Second Rank / Third Rank / Fourth Rank / Fifth Rank												
5102700	Oaks Lake	SE NE	07	105N	38W	9.97	6.0	9.5	9.97	6.0	9.5	6.91	18.1
5102600	Des Moines River above Talcot Lake	SW NE	19	105N	38W	18.3	0.0	10.5	501.	2.7	6.6	95.9	3.2
5102800	Unnamed tributary to Talcot Lake	SW SE	24	105N	39W	7.15	0.1	1.7	7.15	0.1	1.7	6.06	16.2
5102500	Des Moines River above subbasin 5102200	SW NW	20	105N	38W	10.2	14.2	18.5	518.	2.9	6.8	97.2	3.2
5102400	Unnamed tributary to Des Moines River	SE SE	27	105N	38W	2.41	0.0	6.3	2.41	0.0	6.3	3.74	4.4
5102200	Des Moines River above subbasin 5102300	NE NE	01	104N	38W	11.3	0.1	3.3	532.	2.8	6.7	105.	3.0
5102300	Unnamed tributary to Des Moines River	NE NE	01	104N	38W	14.7	2.4	6.6	14.7	2.4	6.6	7.32	9.0
5102100	Des Moines River above Heron Lake Outlet	SE SW	21	105N	37W	8.90	0.0	2.3	555.	2.8	6.6	110.	3.0
5103400	Unnamed tributary above subbasin 5103300	SW NW	10	104N	41W	15.3	0.6	4.6	15.3	0.6	4.6	13.4	9.3
5103600	Unnamed tributary to subbasin 5103400	SW NW	10	104N	41W	5.71	0.0	3.3	5.71	0.0	3.3	4.81	15.2
5103300	Unnamed tributary above subbasin 5105400	NW NE	25	105N	41W	4.04	0.0	1.7	25.1	0.4	3.8	22.0	7.5
5105400	Unnamed tributary to subbasin 5103100	NW NE	25	105N	41W	12.7	1.3	4.5	12.7	1.3	4.5	8.73	13.1
5103200	Judicial Ditch No. 12	SE SE	03	104N	40W	13.2	0.0	0.2	13.2	0.0	0.2	10.9	7.8
5103100	Unnamed tributary to Jack Creek	SW NW	19	104N	39W	20.3	0.0	2.3	71.3	0.4	2.8	43.3	5.7
5103500	Unnamed tributary to Jack Creek	SE SE	30	104N	41W	5.64	0.0	4.8	5.64	0.0	4.8	6.42	10.0
5104500	Unnamed tributary above subbasin 5103500	SE SE	30	104N	41W	4.51	0.0	2.9	4.51	0.0	2.9	5.20	17.8
5104400	Jack Creek above subbasin 5103700	SW SE	22	104N	40W	22.7	0.2	2.0	32.9	0.2	2.6	25.2	7.9
5103700	Unnamed tributary to Jack Creek	SW SE	22	104N	40W	10.8	0.0	1.4	10.8	0.0	1.4	12.1	9.6
5103800	Unnamed tributary to Jack Creek	SE SW	25	104N	40W	6.61	0.0	0.5	6.61	0.0	0.5	11.0	15.4
5104300	Jack Creek above subbasin 5103100	SW NW	19	104N	39W	5.19	0.0	1.7	55.5	0.1	2.0	32.4	7.6
5103000	Unnamed tributary to West Graham Lake	NE NW	21	104N	39W	15.3	1.8	3.5	15.3	1.8	3.5	14.9	7.6

Table 1.—Physical characteristic data for the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins—Continued.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
	First Rank / Second Rank / Third Rank / Fourth Rank / Fifth Rank												
5102900	Judicial Ditch No. 26	NW NE	15	104N	39W	11.8	0.0	1.7	11.8	0.0	1.7	7.02	5.4
5103900	East Graham Lake	SW SE	14	104N	39W	8.37	18.5	24.3	35.4	5.2	7.8	17.9	7.0
5104000	Unnamed tributary to Jack Creek	SW NE	34	104N	38W	7.36	0.0	5.8	42.8	4.3	7.5	26.4	5.3
5104200	Jack Creek above subbasin 5109100	SE SE	26	104N	38W	23.1	0.0	2.6	193.	1.1	3.6	71.1	4.2
5109100	Unnamed tributary to Jack Creek	SE SE	26	104N	38W	5.90	0.0	2.7	5.90	0.0	2.7	5.70	5.5
5109200	Jack Creek	NE SW	33	104N	37W	10.7	0.1	7.0	209.	1.0	3.7	78.4	3.7
5104900	Unnamed tributary to subbasin 5104600	SE SW	17	103N	39W	6.32	0.0	1.3	6.32	0.0	1.3	4.99	16.7
5104600	Unnamed tributary to Elk Creek	NE NW	28	103N	39W	23.2	0.0	1.0	29.5	0.0	1.0	13.7	13.8
5105000	Elk Creek above subbasin 5104600	NW NW	28	103N	39W	24.0	0.0	0.4	24.0	0.0	0.4	16.7	8.2
5105100	Elk Creek	SE SW	31	103N	38W	7.38	0.0	0.5	60.9	0.0	0.7	19.6	9.6
5105300	Okabena Creek above Elk Creek	SE SW	31	103N	38W	22.0	0.0	1.4	22.0	0.0	1.4	15.8	8.1
5104800	Unnamed tributary to Judicial Ditch No. 76	SW SE	07	103N	38W	5.72	0.0	0.6	5.72	0.0	0.6	5.08	16.3
5104700	Judicial Ditch No. 76	NW NW	11	103N	38W	11.7	0.0	2.1	17.5	0.0	1.6	10.5	10.0
5105200	Okabena Creek above subbasin 5109400	SW SE	12	103N	38W	12.0	0.0	2.0	112.	0.0	1.1	36.7	5.2
5109400	Unnamed tributary to Okabena Creek	SW SE	12	103N	38W	21.4	0.0	0.1	21.4	0.0	0.1	10.0	7.6
5109300	Okabena Creek	NE NW	10	103N	37W	4.77	0.0	3.6	138.	0.0	1.0	43.4	4.1
5110500	Unnamed tributary to Judicial Ditch No. 3	NE SW	25	103N	37W	16.4	0.0	0.7	16.4	0.0	0.7	11.1	12.1
5109600	Judicial Ditch No. 3	NE NE	25	103N	37W	14.8	0.1	0.2	31.2	0.1	0.4	11.8	11.7
5110400	Unnamed tributary to South Heron Lake	SW SE	19	103N	36W	3.79	0.0	0.1	3.79	0.0	0.1	5.05	22.2
5110000	Unnamed tributary to South Heron Lake	SE SW	12	103N	37W	7.98	7.7	9.3	7.98	7.7	9.3	5.82	8.0
5109500	South Heron Lake	SE NW	03	103N	37W	26.2	16.0	21.1	208.	2.3	3.8	45.6	3.9

Table 1.—Physical characteristic data for the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins—Continued.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
	First Rank / Second Rank / Third Rank / Fourth Rank / Fifth Rank												
5109700	Main pool of Heron Lake	SE SW	28	104N	37W	13.1	23.9	35.4	430.	2.4	4.7	79.2	3.7
5109000	Duck Lake	SE SW	17	104N	37W	7.25	3.9	10.6	7.25	3.9	10.6	4.47	8.1
5104100	Heron Lake	SE NW	21	104N	37W	7.16	0.8	25.3	444.	2.4	5.2	81.4	3.6
5109800	Unnamed tributary to Heron Lake Outlet	SE NW	22	104N	37W	6.13	4.9	7.6	6.13	4.9	7.6	6.06	7.4
5101700	Heron Lake Outlet	SE SW	21	105N	37W	16.9	0.0	0.8	467.	2.3	5.0	95.1	3.1
5101900	Unnamed tributary to County Ditch No. 29	NE SE	07	105N	37W	8.87	1.3	5.4	8.87	1.3	5.4	4.46	5.6
5102000	County Ditch No. 29 above subbasin 5101900	NE SE	07	105N	37W	7.62	0.0	1.9	7.62	0.0	1.9	6.57	10.9
5101800	County Ditch No. 29	NW SW	12	105N	37W	16.8	0.0	1.2	33.2	0.4	2.5	10.1	5.5
5101400	Unnamed tributary to Des Moines River	SE SW	12	105N	37W	9.06	5.8	8.1	9.06	5.8	8.1	7.61	6.1
5101600	Des Moines River above County Ditch No. 43	SE SW	31	106N	36W	9.86	0.0	4.4	1080.	2.5	5.8	119.	3.0
5100700	County Ditch No. 43	SW SE	31	106N	36W	12.8	0.0	1.7	12.8	0.0	1.7	7.71	16.3
5101500	Des Moines River above subbasin 5100800	NE NW	16	105N	36W	5.94	0.0	4.1	1090.	2.4	5.7	123.	2.9
5100800	Unnamed tributary to Des Moines River	NE NW	16	105N	36W	9.77	3.7	5.9	9.77	3.7	5.9	8.51	11.1
5101200	Des Moines River above subbasin 5101000	SE NW	26	105N	36W	6.69	0.0	4.4	1110.	2.4	5.7	127.	2.9
5100900	Unnamed tributary to Warren Lake	SW NE	13	105N	36W	12.6	0.0	2.1	12.6	0.0	2.1	9.10	5.9
5101001	Unnamed tributary above gaging station near Windom: station number is 05475400	SE NE	14	105N	36W	3.29	0.0	0.1	3.29	0.0	0.1	3.08	22.4
5101000	Unnamed tributary to Des Moines River	SE NW	26	105N	36W	8.71	6.3	8.4	24.6	2.2	4.1	11.8	7.2
5101100	Des Moines River above Judicial Ditch No. 42	SE SW	18	104N	35W	15.8	2.1	5.9	1150.	2.4	5.7	135.	2.8
5109900	Judicial Ditch No. 42 subbasin 5101300	NE SW	13	104N	36W	16.2	0.3	1.6	16.2	0.3	1.6	6.95	18.6
5101300	Judicial Ditch No. 42	SE SW	18	104N	35W	9.95	0.0	2.8	26.2	0.2	2.1	8.38	17.0
5110100	Des Moines River above subbasin 5110200	NE SW	06	103N	35W	9.56	0.0	2.6	1190.	2.4	5.6	140.	2.8

Table 1.—Physical characteristic data for the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins—Continued.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
	First Rank / Second Rank / Third Rank / Fourth Rank / Fifth Rank												
5110200	Unnamed tributary to Des Moines River	NW SE	06	103N	35W	5.69	0.0	0.1	5.69	0.0	0.1	5.55	36.1
5110301	Unnamed tributary above gaging station near Jackson: station number is 05475800	NW SE	27	103N	35W	1.45	0.0	4.2	1.45	0.0	4.2	3.41	20.3
5110300	Des Moines River above subbasin 5110600	NW SW	34	103N	35W	25.3	0.8	1.6	1220.	2.3	5.5	147.	2.7
5110601	Unnamed tributary above gaging station near Lakefield: station number is 05475900	SE SE	32	103N	35W	5.10	0.0	0.6	5.10	0.0	0.6	4.57	13.5
5110600	Unnamed tributary to Des Moines River	NW SW	34	103N	35W	1.10	0.0	0.1	6.20	0.0	0.5	6.71	28.3
5110701	Des Moines River above gaging station at Jackson: station number is 05476000	SE SW	24	102N	35W	15.5	0.0	0.4	1240.	2.3	5.4	153.	2.6
5110700	Des Moines River above subbasin 5110800	NW NW	25	102N	35W	0.23	0.0	0.9	1240.	2.3	5.4	154.	2.6
5110801	Unnamed tributary above gaging station at Jackson: station number is 05476010	NW NW	25	102N	35W	6.15	0.0	0.5	6.15	0.0	0.5	5.11	45.4
5110800	Unnamed tributary to Des Moines River	NW NW	25	102N	35W	0.05	0.0	0.0	6.20	0.0	0.5	5.36	46.7
5200700	Des Moines River above Story Brook Creek	NE SE	07	101N	34W	11.9	0.8	1.6	1260.	2.3	5.3	159.	2.6
5201000	Judicial Ditch No. 6 above subbasin 5200801	NE NE	22	101N	35W	12.4	0.0	0.9	12.4	0.0	0.9	6.02	10.5
5200900	Judicial Ditch No. 6 to above subbasin 5200801	SE SE	15	101N	35W	8.96	0.0	0.4	8.96	0.0	0.4	6.37	27.1
5200801	Judicial Ditch No. 6 above gaging station near Petersburg: station number is 05476100	SE NE	23	101N	35W	3.99	0.0	0.8	25.4	0.0	0.7	7.23	8.5
5200800	Story Brook Creek	NE SE	07	101N	34W	5.27	0.0	0.3	30.7	0.0	0.6	11.2	10.3
5200500	Unnamed tributary to Des Moines River	NW SW	27	101N	34W	23.0	1.8	4.8	23.0	1.8	4.8	13.3	15.8
5200600	Des Moines River above Judicial Ditch No. 11	NE NE	34	101N	34W	10.4	0.0	1.9	1320.	2.2	5.2	164.	2.6
5200200	Judicial Ditch No. 11	NE NE	34	101N	34W	17.1	0.0	0.1	17.1	0.0	0.1	7.68	13.2

Table 1.—Physical characteristic data for the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins—Continued.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
	First Rank / Second Rank / Third Rank / Fourth Rank / Fifth Rank												
5200400	Des Moines River above Iowa border	SE SW	34	101N	34W	1.64	0.0	3.1	1340.	2.1	5.1	166.	2.6
5200100	Judicial Ditch No. 10 above to Iowa border	SW SE	35	101N	33W	13.1	0.0	0.1	13.1	0.0	0.1	7.46	6.5
5301600	Judicial Ditch No. 32 above subbasin 5301100	NE NW	07	102N	33W	13.5	0.0	0.2	13.5	0.0	0.2	7.90	9.5
5301100	Judicial Ditch No. 32	SW SW	08	102N	33W	8.32	0.0	2.5	21.8	0.0	1.1	10.6	7.9
5301200	Unnamed Tributary to East Fork Des Moines River	SW SW	08	102N	33W	13.8	0.0	0.1	13.8	0.0	0.1	12.2	10.7
5301300	East Fork Des Moines River above Fourmile Creek	SE SW	35	102N	33W	9.68	0.0	0.6	45.3	0.0	0.7	19.4	5.4
5301401	Fourmile Creek above gaging station near Dunnell: station number is 05476900	SE NE	03	101N	33W	15.4	0.0	0.1	15.4	0.0	0.1	11.7	13.9
5301400	Fourmile Creek	SE SW	35	102N	33W	0.21	0.0	0.0	15.6	0.0	0.1	12.4	13.7
5300900	East Fork Des Moines River above County Ditch No. 11	SW NW	10	101N	32W	17.4	0.0	0.4	78.3	0.0	0.5	29.3	4.7
5301000	Judicial Ditch No. 50	NE NW	28	102N	32W	24.3	0.0	0.6	24.3	0.0	0.6	17.7	6.5
5300700	County Ditch No. 11 above Judicial Ditch No. 50	SE SW	21	102N	32W	8.59	2.8	4.3	8.59	2.8	4.3	5.01	4.8
5300800	County Ditch No. 11	SW NW	10	101N	32W	8.26	0.0	3.5	41.2	0.6	2.0	22.0	5.8
5300501	East Fork Des Moines River above gaging station near Ceylon: station number is 05476989	NE SE	10	101N	32W	8.72	8.5	11.8	128.	0.8	1.7	30.6	4.6
5300500	East Fork Des Moines River above Okamanpeedan Lake	NE NE	29	101N	31W	14.1	3.3	7.2	142.	1.0	2.3	37.8	3.8
5300600	County Ditch No. 57 above subbasin 5300100	NW NW	33	102N	31W	10.0	0.0	8.4	10.0	0.0	8.4	6.81	4.9
5300100	Unnamed Tributary to Bright Lake	NW NW	09	101N	31W	6.10	6.4	21.5	16.1	2.4	13.4	8.94	3.6

Table 1.—Physical characteristic data for the Des Moines River, Upper Des Moines River, and East Fork Des Moines River Basins—Continued.

Basin number	Stream name and location	Outlet location				By subbasin			Cumulative to mouth of basin				
		Quarter-quarter section	Section	Town-ship	Range	Drainage area (square miles)	Lake area (percent of subbasin area)	Storage area (percent of subbasin area)	Drainage area (square miles)	Lake area (percent of total area)	Storage area (percent of total area)	Main channel length (miles)	Main channel slope (foot per mile)
	First Rank / Second Rank / Third Rank / Fourth Rank / Fifth Rank												
5300200	Clayton Lake	SE SW	21	101N	31W	9.33	16.8	27.2	25.4	7.7	18.4	12.4	2.3
5300300	Okamanpeedan Lake above the Iowa border	SE SE	32	101N	31W	9.18	20.1	27.0	177.	3.0	5.9	40.0	3.5
5301500	County Ditch No. 53 above Iowa border	SW SE	31	101N	32W	14.1	0.0	0.15	14.1	0.0	0.2	12.3	9.3
5300400	Unnamed Tributary to Okamanpeedan Lake	SW SW	31	101N	31W	12.3	0.0	3.4	12.3	0.0	3.4	8.26	6.6